



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/800,195	03/12/2004	Junyan Dai	5347.218	8744
20792	7590	03/27/2006	EXAMINER	
MYERS BIGEL SIBLEY & SAJOVEC			LEE, SIN J	
PO BOX 37428			ART UNIT	PAPER NUMBER
RALEIGH, NC 27627			1752	

DATE MAILED: 03/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/800,195

Applicant(s)

DAI ET AL.

Examiner

Sin J. Lee

Art Unit

1752

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 5,7,8,10-16,19-21,24-26,32-35,38-40,44-48,51,52,54-56 and 64 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12,13,19-21,32-35,45 and 52 is/are allowed.
- 6) ☒ Claim(s) 5,7,8,10,11,14-16,24,25,38-40,44,46,47,51,54-56 and 64 is/are rejected.
- 7) ☒ Claim(s) 26 and 48 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. Claims 1-4, 6, 9, 17, 18, 22, 23, 27-31, 36, 37, 41-43, 49, 50, 53, 57-63, 65 and 66 are canceled claims.
2. In view of the amendment of January 9, 2006, previous 102(b) rejection on claims 1-4, 6, 8, 17, 20-22, 37-40, 57, 58, 65 and 66 over Leveriza et al'247, previous 102(b) rejection on claims 1-4, 6, 8, 18, 20-22, 37-40, 57, 58, 65 and 66 over Watanabe (JP'839) and previous 102(b) rejection on claims 1-4, 22, 37, 40, 57, 58, 65 and 66 over Felter et al'776 are hereby withdrawn.
3. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action (see Paragraph 5 below). Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

***Claim Rejections - 35 USC § 102***

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 5, 7, 8 and 38-40 are rejected under 35 U.S.C. 102(b) as being anticipated by GB 1229066.

GB'066 teaches a block copolymer of A-B-A type which is made by copolymerizing a *vinyltriorganosilane* and *styrene* to form block polymer A and then adding a conjugate diene (such as *isoprene*) to form block B, after which a further addition is made of the mixture of vinyltriorganosilane and styrene (see pg.1, lines 62-80 and Example 2). Thus, GB'066 teaches present inventions of claims 5, 7, 8 and 38-40.

6. Claims 24, 25, 44, 46, 47, 51, 54, and 56 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsumoto et al (5,386,006).

Matsumoto teaches (col.3, lines 34-38) polysilazanes with boron-carbon bonded substituents on the polysilazane backbone, which are prepared by the hydroboration of alkenyl or alkynyl-substituted polysilazanes as well as a composition including such boron-substituted polysilazane. Matsumoto teaches that preferably boron content is 0.3-1.0 wt% in the polymer (col.10, lines 6-14). Therefore, the prior art teaches present inventions of claims 24, 25, 44, 46, 47, 51, 54, and 56 (it is the Examiner's position that Matsumoto's boron-containing polymer or his alkenyl or alkynyl-substituted polysilazane would inherently be capable of being used in a resist process; the term "*resist polymer*" is a recitation of intended use).

7. Claim 55 is rejected under 35 U.S.C. 102(b) as being anticipated by Chung et al (5,247,023).

Chung makes (col.1, lines 7-10) a polymeric hydrocarbon compounds having reactive borane groups at chain ends, or within the polymer chain by an olefin exchange reaction between an unsaturated high molecular weight polymer and a borane monomer (col.3, lines 1-3). As one of examples for the starting polymer, Chung teaches 1,4-polyisoprene (see col.4, lines 12-19). Therefore, Chung teaches present invention of claim 55 (it is the Examiner's position that Chung's 1,4-polyisoprene would inherently be capable of being used in a resist process (the term "resist polymer" is a recitation of intended use) and that Chung's incorporating reactive borane groups into the polymeric hydrocarbon compound would inherently increase the reactive ion etch resistance of the polymer;).

***Claim Rejections - 35 USC § 103***

8. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

9. Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Felter et al (5,989,776) in view of Lin (5,304,453).

Felter teaches (see abstract and col.5, lines 8-26) a method of producing a patterned array of features in the size range of 0.4-0.05  $\mu\text{m}$  (which converts to 400-50  $\text{nm}$ ) using projection lithography and extreme ultraviolet radiation, and Felter performs the lithography by using a photoresist composition containing organosilicon polymer such as poly(cyclohexylmethyl-co-trimethylsilylmethyl silane). Felter coats his photoresist material onto a silicon substrate, and the photoresist is then exposed to extreme UV radiation. After the development, the remaining photoresist is used as an

Art Unit: 1752

etch barrier in the following oxygen plasma etching step. (see col.5, lines 8-46, col.6, lines 16-17). It is well known in the art that the oxygen plasma etching and oxygen reactive ion etching are interchangeable plasma etching techniques, as evidenced by Lin, col.2, lines 48-50. Therefore, it would have been obvious to one of ordinary skill in the art to use oxygen reactive ion etching technique in Felter's invention because oxygen plasma etching and oxygen reactive ion etching were art-recognized equivalents at the time the invention was made. With respect to present dimension range of "less than 50 nm" (*meaning that it could be 49 nm*), since the lower end of Felter's range of 0.4-0.05 um (400-50 nm) is 50 nm (*which is so close to 49 nm*), it is the Examiner's position that Felter's range still renders present range prima facie obvious. Where the claimed ranges and prior art do not overlap but are close enough that one skilled in the art would have expected them to have the same properties, a prima facie case of obviousness would exist which may be overcome by a showing of unexpected results, In re Titanium Metals Corporation of America v. Banner, 227 USPQ 773 (Fed. Cir. 1985). Therefore, Felter in view of Lin would render obvious present invention of claim 64.

10. Claims 5, 7, 10, 11 and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ober et al (5,290,397).

In Example 4, Ober teaches E-beam exposure and development of *pentamethyldisiloxane* modified polystyrene-polyisoprene block copolymer, which contains a silicon weight percent of *at least about 5 percent*. Ober teaches (col.6, lines 1-13) that the silicon component is incorporated into the block copolymer using a

*hydrosilylation* reaction. Ober also teaches that instead of hydrosiloxane such as pentamethyldisiloxane, *hydrosilanes* can also be used in the hydrosilylation reaction in incorporating the silicon component into the block copolymer (see col.6, lines 1-40). Therefore, it would have been obvious to form a hydrosilane modified polystyrene-polyisoprene block copolymer with a reasonable expectation of obtaining bilayer resist which provides good resolution, sufficient etching protection yet also exhibits dimensional stability. Therefore, Ober's teaching renders obvious present inventions of claims 5, 7, 10 and 11.

Ober teaches (col.5, lines 18-20) that his block copolymer has molecular weight range of 500 to 10,000,000. Since this range overlaps with present ranges of claims 14-16, the prior art's range would have made present range *prima facie* obvious. In the case "where the [claimed] ranges overlap or lie inside ranges disclosed by the prior art," a prima facie case of obviousness would exist which may be overcome by a showing of unexpected results, In re Wertheim, 541 F.2d 257, 191 USPQ (CCPA 1976). Therefore, Ober's teaching renders obvious present inventions of claims 14-16.

#### ***Allowable Subject Matter***

11. Claims 26 and 48 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Matsumoto et al '006 does not teach or suggest present polymers listed in claims 26 and 48 (Matsumoto's polymer is polysilazanes with boron-carbon bonded substituents on the polysilazane backbone).

Art Unit: 1752

12. Claims 12, 13, 19-21, 32-35, 45 and 52 are allowed. None of the cited prior arts teaches or suggests the present poly(dimethylphenylvinylsilane-b-isoprene) of claim 12 or the present poly(trimethylsilylstyrene-b-isoprene) of claim 13. None of the cited prior arts teaches or suggest present polymers of claims 19 and 20. None of the cited prior arts teaches or suggest present polymer of claim 32, 34 or 35. Matsumoto et al'006 does not teach or suggest present hydroboration agent, dimesitylborane, of claims 45 and 52.

### ***Response to Arguments***

13. Applicants argue that since claims 24, 25, 44, 46, 47, 51, 54 and 56 are amended to recite boron-containing resist polymers, the 102(b) rejection on those claims over Matsumoto should be withdrawn. However, as discussed above, the term "resist polymer" is a recitation of intended use, and it is the Examiner's position that Matsumoto's boron-containing polymer or his alkenyl or alkynyl-substituted polysilazane would inherently be capable of being used in a resist process (present claims are not resist process claims). Applicants argue that since claim 55 is amended to recite a method for increasing the reactive ion etch resistance of a resist polymer by incorporating boron atoms into a resist polymer, the 102(b) rejection on Chung et al should be withdrawn. However, as discussed above, the term "resist polymer" is a recitation of intended use, and it is the Examiner's position that Chung's 1,4-polyisoprene would inherently be capable of being used in a resist process and that Chung's incorporating reactive borane groups into the polymeric hydrocarbon compound would inherently increase the reactive ion etch resistance of the polymer.



Art Unit: 1752

Applicants argue that since claim 64 recites features having at least one dimension less than 50 nm and since Felter does not teach or suggest a method of creating features less than 50 nm, Felter does not render present claim 64 obvious. However, as discussed above, present dimension range of "less than 50 nm" can include 49 nm, and since the lower end of Felter's range is 50 nm (*which is so close to 49 nm*), it is the Examiner's position that Felter's range still renders present range prima facie obvious. Where the claimed ranges and prior art do not overlap but are close enough that one skilled in the art would have expected them to have the same properties, a prima facie case of obviousness would exist which may be overcome by a showing of unexpected results, In re Titanium Metals Corporation of America v. Banner, 227 USPQ 773 (Fed. Cir. 1985). With respect to present rejection over Ober reference, applicants argue that the Examiner has engaged in impermissible and improper hindsight reconstruction to establish the present rejection. However, "[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and *does not include knowledge gleaned only from* applicant's disclosure, such a reconstruction is *proper*." In re McLaughlin 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971). See MPEP 2145. As discussed above, because Ober teaches that the silicon component is incorporated into the block copolymer through a hydrosilylation reaction by using hydrosiloxane or hydrosilanes, it would have been obvious to one skilled in the art to form a hydrosilane modified polystyrene-polyisoprene block copolymer with a reasonable expectation of obtaining

Art Unit: 1752

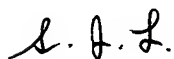
bilayer resist which provides good resolution, sufficient etching protection yet also exhibits dimensional stability.

For those reasons stated above, present rejections still stand.

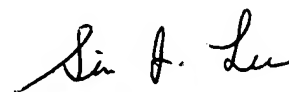
14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333. The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cynthia Kelly, can be reached on 571-272-1526. The fax phone number for the organization where this application or proceeding is assigned is **571-273-8300**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



S. Lee  
March 20, 2006



**SIN LEE**  
**PRIMARY EXAMINER**